

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

ENGINEERING DIVISION

APPLICATION PROCESSING AND CALCULATIONS

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APPLICANT'S NAME: NORTHROP GRUMMAN SPACE AND
MISSION SYSTEMS CORP.

FACILITY PERMIT ID# 800408

CONTACT PERSON: RON FRAZER

MAILING ADDRESS: ONE SPACE PARK
BUILDING CS1/1800
REDONDO BEACH, CA 90278

EQUIPMENT ADDRESS: 1700 Rosecrans Ave., BLDG D1
Manhattan Beach, CA 90266

Title V/RECLAIM Permit Revision:
Application No. 474049

PERMIT TO CONSTRUCT**Equipment Description: (Previous Application 412445)**

PROCESS 1: CONTROL EQUIPMENT					
Equipment	Device ID	Connected To	Source Type/ Monitoring Unit	Emissions	Equipment Specific Conditions
SCRUBBER, PACKED BED, HARRINGTON, MODEL NO. HPH 55-4. Reference A/N 474041	C-4	D38 , D590, D591, D592 D546 ADD		PM: (9) [RULE 404, 2-7-1986]	C8.2, C8.9, D90.1, E158.1, E159.1, K67.3

Conditions:

C8.2 THE OPERATOR SHALL USE THIS EQUIPMENT IN SUCH A MANNER THAT THE FLOW RATE BEING MONITORED, AS INDICATED BELOW, IS NOT LESS THAN 60 GPM.

To comply with this condition, the operator shall install and maintain a(n) flow meter to accurately indicate the flow rate of the recirculating scrubbing solution.

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C8.9 THE OPERATOR SHALL USE THIS EQUIPMENT IN SUCH A MANNER THAT THE pH BEING MONITORED, AS INDICATED BELOW, IS NOT LESS THAN 8 OF THE pH SCALE

To comply with this condition, the operator shall monitor and record the pH as specified in condition D90.1.

D90.1 THE OPERATOR SHALL PERIODICALLY MONITOR THE pH OF THE SCRUBBING SOLUTION ACCORDING TO THE FOLLOWING SPECIFICATIONS:

The operator shall use litmus paper or a portable pH analyzer to monitor the parameter.

The operator shall monitor once every day provided any equipment served by this control system is in operation.

E158.1 THE OPERATOR SHALL MAINTAIN A CONTINUOUS OVERFLOW OF WATER FROM THE SCRUBBER SUMP TO PREVENT THE BUILD UP OF CONTAMINATION.

E159.1 THE OPERATOR SHALL MAINTAIN INSPECTION PORTS WHICH, WHEN OPENED, ALLOW THE OBSERVATION OF THE SPRAY NOZZLES AND SCRUBBING SOLUTION BEING SPRAYED ON THE PACKING.

K67.3 THE OPERATOR SHALL KEEP RECORDS, IN A MANNER APPROVED BY THE DISTRICT, FOR THE FOLLOWING PARAMETERS OR ITEMS:

pH of scrubbing solution on a daily basis.

Flow rate of recirculating scrubbing solution on a daily basis.

Equipment Description:(Previous application no. 412396)**PROCESS 14: SURFACE PREPARATION****SYSTEM #1: Etching Line**

Equipment	Device ID	Connected To	Source Type/ Monitoring Unit	Emissions	Equipment Specific Conditions
BENCH, WET STATION, HBT, NO.2, UNHEATED	D546	C4			B59.4 B59.63
Reference A/N 474044					

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B59.4 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

MATERIALS CONTAINING VOC.

B59.63 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

TOXIC AIR CONTAMINANTS IN TABLE 1 OF RULE 1401 WITH A LISTING DATE OF 3/04/05 OR EARLIER EXCEPT NITRIC ACID, AND HYDROFLUORIC ACID.

Background:

Northrop filed applications 474041 (previous a/n 412445) & 474044 (previous a/n 412396) for the relocation of wet bench D546 from process 13, system 3 to process 14, system 1. Wet bench D546 will be replacing etcher D38. The process to be used in D546 will be the same as currently employed in D38, which is generally etching and rinsing. Also, an application is submitted for the modification to the exhaust of existing scrubber (C4) to connect wet bench device D564.

This is a RECLAIM Cycle 1 title V facility. The proposed project is considered as a “de minimus” significant permit revision to this facility’s title V permit.

The facility has had no citizen complaints filed or Notices to Comply issued in the last two years. However, the facility was issued a Notice of Violation on 11/8/2006 for failure to submit 3rd quarter, cycle 1 RECLAIM emission report in a timely manner. The facility is currently operating in compliance with all applicable rules and regulations.

Process Description:

This is a wet chemical operation used to manufacture microcircuits on gallium arsenide wafers for various micro-electronic applications. Etching bench D546 will replace the etching process conducted in D38 with no changes in the process used. Initially the wafers are developed by removing soften photoresist using a microposit developer CD-30 or equivalent. These are caustic and have a negligible vapor pressure. The next step is to rinse the wafers in deionized water, etch the wafers in a hydrogen peroxide solution, and etch in a solution of nitric acid and hydrofluoric acid. The etching process is conducted in unheated compartments measuring 20” x 12.5”. The etching compartments will be kept covered except when solution or wafers are being added or removed.

Scrubber Evaluation:

This scrubber has a design capacity of 11,500 cfm. The total cfm vented to existing devices is 9,000cfm. D38 will be replaced by D546. These devices have the same air flow requirements 580 cfm. By replacing D38, there will be no impact on the scrubber capacity. Therefore, this scrubber will be able to vent the proposed change.

Emissions Calculations:

Hydrogen peroxide, hydrogen fluoride and nitric acid are used to etch the developed wafers to create the microcircuit structures. The materials are hand applied within the sinks using a spray bottle. The wafers are soaked for a period of time and then rinsed. The etchant is drained to a hazardous waste tank. All these materials have a low vapor pressure and carried out under a ventilated hood which is vented to a scrubber. The emissions from these processes are essentially zero. See appendix A for emission calculations.

Risk Assesement:

Device 546 uses Nitric Acid and Hydrofluoric Acid. Nitric acid will not cause an emission increase since the vapor pressure is negligible. The hydrofluoric acid emissions of 0.0000383 lbs/hr is well below the Tier 1 threshold of 0.12 lbs/hr. Compliance with Rule 1401 is expected.

Evaluation & Rule Review

Rule 212 (c)(1): This section requires a public notice for all new or modified permit units that emit air contaminants located within 1,000 feet from the outer boundary of a school.

No public notice is required since no school is located within 1,000 ft from the above site.

Rule 212 (c)(2): This section requires a public notice for all new or modified facilities that have on-site emission increases exceeding any of the daily maximums as specified by Rule 212(g).

The proposed project will result in a small emission increase for the entire facility. A Rule 212(c) (2) notice will not be triggered since the emission increase is below the daily maximum specified in Rule 212(g).

Rule 212(c)(3): This section requires a public notice for all new or modified permit unit with increases in emissions of toxic air contaminants listed in Table I of Rule 1401 resulting in MICR greater than 1E-6 per permit unit or greater than 10E-6 per facility.

The proposed project will not result in an emission increase of toxic emissions in excess of a Acute Hazard index of 1.0 nor will there be an increase MICR in excess of one in a million. Therefore Public Notice is not required under this section of the rule.

Rule 212(g): This section requires a public notice for all new or modified sources that result in emission increases exceeding any of the daily maximums as specified by Rule 212(g).

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The emission increase due to the operation of this equipment is negligible and the following summarizes the emission increase:

	Maximum Daily Emissions					
	<u>ROG</u>	<u>NO_x</u>	<u>PM₁₀</u>	<u>SO₂</u>	<u>CO</u>	<u>Pb</u>
Emission increase	0	0	0	0	0	0
MAX Limit (lb/day)	30	40	30	60	220	3
Compliance Status	Yes	Yes	Yes	Yes	Yes	Yes

No public notice is required since the emission increase is below the thresholds.

Rule 401: With the proper maintenance and operation of this equipment, compliance with this rule is expected.

Rule 402: With proper maintenance and operation, this equipment is not expected to create a nuisance.

Rule 1303(a): The emissions from the etching operation are vented to a scrubber which is BACT for this type of operation. Compliance with BACT is achieved.

Rules 1303(b)(1) modeling:

The PM₁₀ emissions from this operation are less than 0.41lbs/hr.
Compliance is expected.

Rule 1303(b)(2) Offsets:

No offsets are required for this operation. There is no emission increase.

Rule 1303(b)(4): The facility is expected to be in full compliance with all applicable rules and regulations of the District.

Rule 1401: The change in the equipment will not cause an emission increase therefore there is no impact on the toxic emissions. Compliance with this rule is expected.

RULE 2005: Northrop Grumman is a NO_x RECLAIM facility. The proposed project will not result in an increase in NO_x emissions. Compliance with rule is expected.

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REGULATION XXX:

This facility is in the RECLAIM program. The proposed project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants to the RECLAIM/Title V permit for this facility.

Non-RECLAIM Pollutants or HAPs

Rule 3000(b)(6) defines a “de minimis significant permit revision” as any Title V permit revision where the cumulative emission increases of non-RECLAIM pollutants or HAPs from these permit revisions during the term of the permit are not greater than any of the following emission threshold levels:

Air Contaminant	Daily Maximum (lbs/day)
HAP	30
VOC	30
NO _x *	40
PM ₁₀	30
SO _x *	60
CO	220

* Not applicable if this is a RECLAIM pollutant

To determine if a project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants or HAPs, emission increases for non-RECLAIM pollutants or HAPs resulting from all permit revisions that are made after the issuance of the Title V renewal permit shall be accumulated and compared to the above threshold levels. This proposed project is the 5th permit revision to the Title V renewal permit issued to this facility on July 9, 2006. The following table summarizes the cumulative emission increases resulting from all permit revisions since the Title V renewal permit was issued:

Revision	HAP	VOC	NO_x*	PM₁₀	SO_x	CO
Previous Permit Revision Total Cummulative to date. Title V permit renewed July 9, 2006	0	0	1	5	0	1
5th Permit Revision: Replacement of D360 by D482, venting D482 to C364, a/n 474053 & 474064	0	0	0	0	0	0
Replacement of D38 by D546 and venting D546 to C4, a/n 474041 & 474044	0	0	0	0	0	0

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	0	0	0	0	0	0
Cumulative Total	0	0	1*	5	0	1
Maximum Daily	30	30	40*	30	60	220

* RECLAIM pollutant, not subject to emission accumulation requirements

Since the cumulative emission increases resulting from all permit revisions are not greater than any of the emission threshold levels, this proposed project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants or HAPs.

RECOMMENDATION

The proposed project is expected to comply with all applicable District Rules and Regulations. Since the proposed project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants, it is exempt from the public participation requirements under Rule 3006 (b). A proposed permit incorporating this permit revision will be submitted to EPA for a 45-day review pursuant to Rule 3003(j). If EPA does not raise any objections within the review period, a revised Title V permit will be issued to this facility.

Conclusion:

This equipment will operate in compliance with all District Rule and Regulations. A Permit to Construct is recommended for application number 474041 and 474044 subject to preceding conditions.

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Appendix A

Emission Calculations

Container Headspace Volume = (20" x 12.5" x 1.0")/(1728 in³) = 0.1447 ft³

Hydrogen peroxide 30%

SPGR = 1.11 Density = 9.246 lbs/gal

Vapor Pressure = 23.3 mmhg, 0.031 atm

MWH₂O₂ = 32.02 lb/lbmole

$$PV = nRT$$

$$n = PV/RT$$

$$P = 0.031 \text{ atm}$$

$$V = \text{Headspace volume } 0.1447 \text{ ft}^3$$

$$R = 0.7302 \text{ ft}^3\text{-atm/lb-mol R}$$

$$T = 528 \text{ R}$$

$$n = \frac{0.031 \text{ atm}(0.1447 \text{ ft}^3)}{0.7302(528 \text{ R})}$$

$$n = 0.0000116 \text{ lb-mole}$$

$$M = 0.0000116 \text{ lbmole}(32.02 \text{ lbs/lbmole}) = 0.000373 \text{ lbs per batch}$$

One Batch per hour:

$$R1 = 0.000373 \text{ lbs/hr}$$

$$R2 = 0.000373 \text{ lbs/hr}(1-0.9) = 0.0000373 \text{ lbs/hr}$$

Tantalum Nitride Etch:Hydrofluoric Acid

6parts:4parts

Assume 6 gallons TNE+4 gallons HF

SPGR TNE = 1.02 8.5 lbs/gal

SPGR HF = 1.18 9.83 lbs/gal

TNE 15wt% HF 40wt% HNO₃

HF 48wt%

Final HF/HNO₃ weight percents

HF Balance:

$$6.0 \text{ Gal}(8.5 \text{ lbs/gal}) + 4.0 \text{ gal}(9.83 \text{ lbs/gal}) = 90.32 \text{ lbs total}$$

mass HF

$$6.0 \text{ gal}(8.5 \text{ lbs/gal})(0.15) + 4.0 \text{ gal}(9.83 \text{ lbs/gal})(0.48) = 26.52 \text{ lbs HF}$$

HF wt%

$$(26.52 \text{ lbs HF})/(90.32 \text{ lbs total})100 = 29.4 \text{ wt\% HF}$$

HNO₃ balance:mass HNO₃

$$6.0 \text{ gal}(8.5 \text{ lbs/gal})(0.40) = 20.40 \text{ lbs HNO}_3$$

HNO₃ wt%

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$$20.40\text{lbs HNO}_3 / (90.32\text{ lbs total}) 100 = 22.59\text{ wt\%}$$

According to Perry's 6th edition, the vapor pressure for HNO₃ at ambient temperature is zero for weight percents of 40 or less. At 22.59% HNO₃, the vapor pressure is 00 mmhg.

The vapor pressure of HF at ambient temperature according to the Honeywell chart dated 2002 shows it to be around 1.0 mmHg.

Headspace volume = 0.1447 ft³

HF Vapor pressure = 1.0 mmHg, 0.00132 atm

MW_{HF} = 20.01

$$PV = nRT$$

$$n = PV/RT$$

$$P = 0.00132\text{ atm}$$

$$V = \text{Headspace volume } 0.1447\text{ ft}^3$$

$$R = 0.7302\text{ ft}^3\text{-atm/lb-mol R}$$

$$T = 528\text{ R}$$

$$n = \frac{0.00132\text{ atm}(0.1447\text{ ft}^3)}{0.7302(528\text{ R})}$$

$$n = 0.00000049\text{ lb-mole}$$

$$M = 0.00000049\text{ lbmole}(20.01\text{ lbs/lbmole}) = 0.0000099\text{ lbs per batch}$$

One Batch per hour:

$$R_1 = 0.0000099\text{ lbs/hr}$$

$$R_2 = 0.0000099\text{ lbs/hr}(1-0.9) = 0.00000099\text{ lbs/hr}$$

Total hydrogen peroxide and HF/Nitric Acid emissions are:

$$R_1 = 0.000373\text{ lbs/hr} + 0.0000099\text{ lb/hr} = 0.000383\text{ lbs/hr}$$

$$R_2 = 0.0000373\text{ lbs/hr} + 0.00000099\text{ lbs/hr} = 0.0000383\text{ lbs/hr}$$